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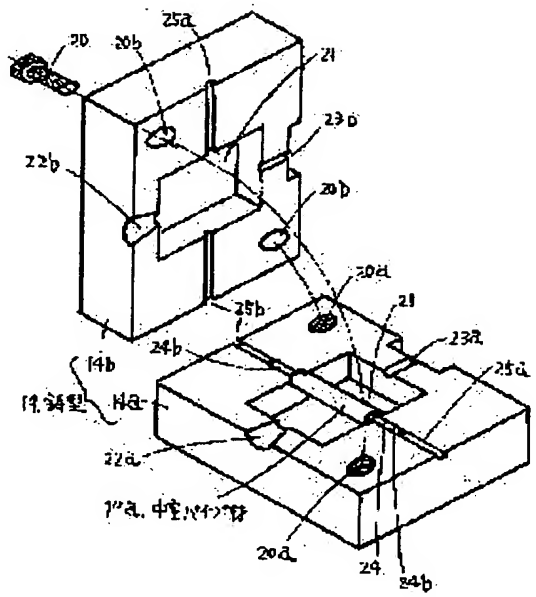
(54) METHOD FOR PRODUCING AMORPHOUS ALLOY-MADE MEMBER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for producing an amorphous alloy-made member by which a hole or a female screw hole can be formed even if they are not machined.
SOLUTION: In the production method for the amorphous alloy-made member for casting molten master alloy of the amorphous alloy, the master alloy is cast after laying a hollow pipe material having the same inner diameter as the desired hole in a mold, or, the master alloy is cast after laying a nut having the same female screw hole as the desired female screw in the mold.



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[Claim(s)]

[Claim 1]A manufacturing method of a member made from an amorphous alloy manufacturing a member made from an amorphous alloy characterized by comprising the following.

A process of teaching into a mold a part of member manufactured by a separated process.

A part of member which has the process of casting a hardener to a part of circumferences of a member taught into a mold, and casting a member made from an amorphous alloy, and was manufactured by a separated process.

[Claim 2]It is the method of manufacturing a member made from an amorphous alloy which casts a hardener of a dissolved amorphous alloy to a mold, carries out quenching casting, and has a hole, Since hollow pipe material which has an inside diameter equal to a desired hole is taught to a hole position in a mold, A manufacturing method of a member made from an amorphous alloy forming a hole which casts a hardener to the circumference of said hollow pipe material, casts a member made from an amorphous alloy to it, and becomes it from a centrum of said hollow pipe material into a member made from an amorphous alloy.

[Claim 3]It is the method of manufacturing a member made from an amorphous alloy which casts a hardener of a dissolved amorphous alloy to a mold, carries out quenching casting, and has a female screw hole, Since a nut which has a female screw hole equal to a desired female screw hole is taught to a female screw hole position in a mold, A manufacturing method of a member made from an amorphous alloy forming a female screw hole which casts a hardener to the circumference of said nut, casts a member made from an amorphous alloy to it, and becomes it from a female screw hole of said nut into a member made from an amorphous alloy.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the manufacturing method of the member which consists of amorphous alloys. It is related with the manufacturing method of the member made from an amorphous alloy which has a hole, and the member made from an amorphous alloy which has a female screw

hole in more detail.

[0002]

[Description of the Prior Art]An amorphous alloy is an amorphous alloy which will get if the name shows, and does not take a crystal structure. Compared with the metallic material of the usual crystalline substance, although it is amorphous therefore, it excels in corrosion resistance, and there is the characteristic of having hardness high moreover and intensity. In recent years, the application covering many fields is expected or developed paying attention to these characteristics.

[0003]An amorphous alloy is usually an alloy which comprises a multi element, and are those with an alloy which are being solidified with the atomic arrangement of the liquid state in which atomic arrangement was confused irregularly, and an amorphous alloy which does not take a crystal structure as mentioned above.

[0004]As a method of producing such an amorphous alloy, the multi element alloy of a crystalline substance is dissolved, it is made a liquid state, and the method of quenching compulsorily at a stretch is generally taken from the liquid state in which atomic arrangement is confused irregularly. That is, you are making it solidify in an instant as the atomic arrangement currently confused irregularly was held without giving hair while the atomic arrangement currently irregularly confused depending on quenching from a liquid state shifted to regular arrangement and crystallized.

[0005]However, if any multi element alloys are dissolved and forcible quenching is actually carried out at a stretch from a liquid state here, an amorphous alloy will not necessarily be obtained, There are some multi element alloys which grow into an amorphous alloy easily depending on the combination and composition ratio of an element of a multi element alloy, and there are some multi element alloys which cannot grow into an amorphous alloy easily. As an example of representation of the multi element alloy which grows into an amorphous alloy easily or can incidentally grow into an amorphous alloy, a zirconium system amorphous alloy (presentation: -- zirconium 55at%.) Aluminum 10at%, nickel 5at%, there are copper 30at%, a palladium system amorphous alloy (presentation: palladium 40at% and copper 10at% and nickel 10at% and Lynn 20at%), etc., and they are known.

[0006]Below, a procedure is explained for the manufacturing method of the amorphous alloy mentioned above later on more concretely.

[0007]First, after the first process dissolves two or more elements using a high frequency induction furnace or an arc melting device and mixes two or more elements uniformly, it is cooled and solidified and produces a hardener. A high frequency induction furnace or an arc melting device used here does not have a means to quench the dissolved sample compulsorily. Therefore, cooling here turns into late cooling of the cooling rate by natural heat dissipation. Therefore, in the stage of a hardener state produced here, it is still an alloy of the crystalline substance which shifted to arrangement with a regular atomic arrangement instead of an amorphous alloy.

[0008]Although the next is a process which makes amorphous the hardener of the crystalline substance produced at the above-mentioned process, and is used as an amorphous alloy, it is explained based on a drawing.

[0009]Drawing 2 is an approximate account figure of the amorphous alloy manufacturing device used in order to make the hardener of a crystalline substance amorphous and to produce an amorphous alloy. The hardener 11 which should be carried out [amorphous]-izing is paid into the syringe 12 made from silica glass. The inactive gas introduction port 12a is established in the upper bed part of the syringe 12, and the nozzle hole 12b is established in the lower tip of the syringe 12. The high-frequency-induction coil 13 of the high frequency induction furnace is installed in the peripheral part of the syringe 12. The copper molds 14 are arranged to the lower part of the nozzle hole 12b. And all the above-mentioned things are dedicated in the chamber 15. The vacuum suction port 16 and the inactive gas introduction port 17 are established in the chamber 15.

[0010]Depending on the amorphous alloy manufacturing device shown in drawing 2, the following work sequence performs foundry practice, and amorphous-ization of the hardener 11, i.e., production of an amorphous alloy, is performed. First of all, with the vacuum pump (not shown) connected to the vacuum suction port 16, the inside of the chamber 15 is exhausted and it is made a vacuum. If evacuation is ended, the inactive gas of a slight quantity of the grade which maintains the pressure in the chamber 15 at negative pressure will be introduced in the chamber 15 from the inactive gas introduction port 17, and the inside of the chamber 15 will be adjusted to the inert gas atmosphere of negative pressure. When

adjustment with the pressure in the chamber 15 and atmosphere is completed, current is sent through the high-frequency-induction coil 13, and the hardener 11 paid into the syringe 12 is heated, and it is made to dissolve. If fusion of the hardener 11 is terminated, only suitable time will introduce inactive gas by a pressure suitable from the inactive gas introduction port 12a, will pressurize the inside of the syringe 12, the dissolved hardener 11 will be made to inject from the nozzle hole 12b, and it will cast into the mold 14.

[0011]In above-mentioned work sequence, the inside of the chamber 15 is adjusted to the inert gas atmosphere of negative pressure in the process in which the hardener 11 is heat-treated in order to prevent the hardener 11 from oxidizing.

[0012]The hardener 11 of the melting state cast into the mold 14 by above-mentioned work sequence, Heat is taken quickly and contact with the mold 14 quenches, and with the atomic arrangement held currently confused irregularly, in an instant, it solidifies the cavity (not shown) and the shape of isomorphism of the mold 14, and becomes an amorphous alloy which does not take a crystal structure. That is, the lump of the cavity (not shown) of the mold 14 and an isomorphism-like amorphous alloy is produced.

[0013]The mold 14 is made into copper here, as mentioned above, but this is because copper is suitable for thermal conductivity being good, and taking and quenching heat quickly from the hardener 11 of a melting state. It is because this quenching is important and is required conditions, when cooling to urgency more is connected with solidifying an instant, with the atomic arrangement held currently confused irregularly and it produces an amorphous alloy.

[0014]Although drawing 2 did not show, as a means for considering it as more rapid cooling, the waterway which lets cooling water pass is provided into the mold 14 the same with making the mold 14 into copper, and the method of water-cooling the mold 14 is often taken. Otherwise, size of the mold 14 is enlarged and it is taken as a means by which enlarging calorific capacity of the mold 14 also makes a cooling rate quick.

[0015]The amorphous alloy is produced by the method explained above.

[0016]And in order to manufacture the member made from an amorphous alloy which consists of amorphous alloys, In the manufacturing method of the amorphous alloy explained above, the shape of the member considered as the

request at the mold 14 provides the cavity (not shown) of the shape which reversed unevenness, and the method of carrying out quenching casting of the hardener 11 which carried out melting is taken.

[0017]That is, grant of desired appearance shape is performed by transferring the cavity form of the mold 14 at the same time it considers it as an amorphous amorphous alloy by carrying out quenching casting of the hardener 11 of a crystalline substance as a manufacturing method of the member made from an amorphous alloy.

[0018]And when the shape of the member made from an amorphous alloy considered as the request has a hole, cutting by perforation cutting tools, such as a drill, is performed to the member which acquired outline shape by transfer of the cavity form of the mold 14, and the hole is formed in it.

[0019]When the shape of the member made from an amorphous alloy considered as the request has a female screw hole, After performing cutting by perforation cutting tools, such as a drill, to the member which acquired outline shape by transfer of the cavity form of the mold 14 and forming a prepared hole in it, cutting by screw thread cutting tools, such as a tap, is performed, a female screw mountain is formed, and the female screw hole is formed.

[0020]As mentioned above, in the method of manufacturing the member made from an amorphous alloy which has a hole or a female screw hole, When carrying out quenching casting of the hardener 11 and considering it as an amorphous alloy as conventional technology, after transfer of the cavity form of the mold 14 gives the outline shape of a desired member to an amorphous alloy, there is the method of forming a hole or a female screw hole by cutting after that.

[0021]

[Problem(s) to be Solved by the Invention]However, an amorphous alloy has the characteristic of having high hardness, compared with the metallic material of the usual crystalline substance, as mentioned above. as the example of representation of an amorphous alloy -- said zirconium system amorphous alloy (presentation: -- zirconium 55at%.) carried out With copper 30at% and a palladium system amorphous alloy (presentation: palladium 40at% and copper 10at% and nickel 10at% and Lynn 20at%), it has 500 or more-Hv hardness with Vickers hardness nickel 5at% aluminum 10at%. And saying that

this hardness is high is also a factor which cuts difficult, and an amorphous alloy is also a charge of an unscrapable material with difficult cutting.
[0022]Therefore, in manufacture of the member made from an amorphous alloy which has a hole or a female screw hole, The method of forming a hole or a female screw hole by cutting, after transfer of the cavity form of the mold 14 gives the appearance shape of a desired member to an amorphous alloy, when carrying out quenching casting of the aforementioned conventional technology 11, i.e., the hardener, and considering it as an amorphous alloy, Although the amorphous alloy has high hardness, since it is a charge of an unscrapable material of a reason, it has the technical problem that it is a method difficult for carrying out.
[0023]In order to form a quality hole or a female screw hole, specifically, it has the technical problem referred to as having to set up the terms and conditions in connection with cutting of what kind of tool should be used, into how much cutting speed should be made, or what kind of cutting fluid to use the optimal.
[0024]About the cutting fluid which carries out the duty which cools the temperature increase by plastic working produced in a processing point, especially prudent conditioning is required, and it is difficult at the same time it gives the cut part of the member made from an amorphous alloy, and the tip part of a cutting tool during cutting and gives lubricity at a processing point. Although the atomic arrangement of an amorphous alloy is irregular and the reason is an amorphous alloy which has not taken the crystal structure, it is because an atomic arrangement will be regularly located in a line and it will change to the alloy of a crystalline substance, if a certain temperature is reached depending on heating.
[0025]The temperature which causes the change in the crystalline substance state from this amorphous state is called recrystallizing temperature. incidentally -- as the example of representation of an amorphous alloy -- said zirconium system amorphous alloy (presentation: -- zirconium 55at%.) carried out Aluminum 10at%, nickel 5at%, the recrystallizing temperature in copper 30at% is about 360 **, and the recrystallizing temperature in a palladium system amorphous alloy (presentation: palladium 40at% and copper 10at% and nickel 10at% and Lynn 20at%) is about 470 **.
[0026]Therefore, in cutting of an amorphous alloy, prudent conditioning is needed about the cutting fluid which cools a processing point.

Temporarily, when cooling of the processing point by cutting fluid is insufficient during cutting of an amorphous alloy member, If the accumulation of temperature increase by plastic working arises in an amorphous alloy member and the temperature reaches recrystallizing temperature, there is a problem that the amorphous alloy member which should be amorphous will turn into an alloy member of a crystalline substance.
[0027]About the conditioning about a cutting tool, to the amorphous alloy which has the above-mentioned high altitude which was carried out, if a tool hard enough more than it is not chosen, it learns, and there is also **********. Even if it chooses a tool with sufficient hardness, when an amorphous alloy with high hardness will be cut, wear of a tool tip advances violently and the problem that it is remarkable and short also has a tool life.
[0028]therefore, this invention is made in view of this problem, and comes out. In the manufacturing method of the member made from an amorphous alloy which has a female screw hole, even if the purpose forms neither a hole nor a female screw hole by cutting, there is in providing the manufacturing method of the member made from an amorphous alloy which can form a hole or a female screw hole.

[0029]
[Means for Solving the Problem]To achieve the above objects, a means of a statement is adopted as the following in a manufacturing method of a member made from an amorphous alloy of this invention.
[0030]The invention according to claim 1 inserts into a mold at least a part of member manufactured by other processes among this inventions, casting a hardener to a part of circumferences inserted into said mold -- said -- others -- amorphous alloy parts obtained by casting a member manufactured by a process and said hardener are formed in a member of one
[0031]It is the method of manufacturing a member made from an amorphous alloy which the invention according to claim 2 casts a hardener of a dissolved amorphous alloy to a mold, carries out quenching casting among this inventions, and has a hole, Since hollow pipe material which has an inside diameter equal to a desired hole is taught to a hole position in a mold, a hole which casts a hardener to the circumference of said hollow pipe material, casts a member made from an amorphous alloy to it, and becomes

it from a centrum of said hollow pipe material is formed into a member made from an amorphous alloy.

[0032]It is the method of manufacturing a member made from an amorphous alloy which the invention according to claim 3 casts a hardener of a dissolved amorphous alloy to a mold, carries out quenching casting among this inventions, and has a female screw hole, Since a nut which has a desired female screw hole and an equal female screw hole is taught to a female screw hole position in a mold, a female screw hole which casts a hardener to the circumference of said nut, casts a member made from an amorphous alloy to it, and becomes it from a female screw hole of said nut is formed into a member made from an amorphous alloy.

[0033]

[Embodiment of the Invention]Hereafter, the example of an embodiment of the invention is described based on a drawing.

[0034]Drawing 3 is an explanatory view including the important section sectional view showing the example of the member made from an amorphous alloy which has a hole manufactured or a female screw hole with the manufacturing method of the member made from an amorphous alloy by this invention.

[0035]Drawing 3 (a) and drawing 3 (b) are the examples of the member made from an amorphous alloy which has a hole. Drawing 3 (a) is the member 18 made from an amorphous alloy which has the through hole 18a, and drawing 3 (b) is the member 18 made from an amorphous alloy which has the sac hole 18b.

[0036]Drawing 3 (c) and drawing 3 (d) are the examples of the member made from an amorphous alloy which has a female screw hole. Drawing 3 (c) is the member 18 made from an amorphous alloy which has the penetration female screw hole 18c, and drawing 3 (d) is the member 18 made from an amorphous alloy which has 18 d of bag female screw holes.

[0037](The first example) The method of manufacturing the member 18 made from an amorphous alloy which has first the through hole 18a shown in drawing 3 (a) with the manufacturing method of the member made from an amorphous alloy of this invention as the first example here is explained below.

[0038]In order to manufacture the member 18 made from an amorphous alloy which has the through hole 18a shown in drawing 3 (a) with the manufacturing method of the member made from an amorphous alloy of this invention, After

teaching and putting the hollow pipe material which has an inside diameter equal to a desired hole on the hole position in a mold, are a translation which forms the hole which casts a hardener to the circumference of said hollow pipe material, casts the member 18 made from an amorphous alloy to it, and becomes it from the centrum of said hollow pipe material into the member 18 made from an amorphous alloy, but. How to teach and put the hollow pipe material which has an inside diameter equal to a desired hole on the hole position in a mold beforehand which casts a hardener is explained based on drawing 1.

[0039]Drawing 1 is a decomposition explanatory view of the mold 14 in which the state where the hollow pipe material 19a which has an inside diameter equal to a desired hole was taught to the hole position in the mold 14 in the manufacturing method of the member made from an amorphous alloy of this invention is shown, It is the first example in the case of manufacturing the member made from an amorphous alloy which has the through hole shown in drawing 3 (a).

[0040]The mold 14 consists of copper parts of two bodies of the cavity block 14a and the cavity block 14b, and is made into the structure [halving is possible and] which can take out easily the member made from an amorphous alloy (not shown) cast depending on halving after foundry practice. Provide, and have established the female screw hole 20a in one cavity block 14a, and there is the bolthole 20b in another cavity block 14b, and depending on attachment and detachment of the bolt 20. It is possible to assemble the cavity block 14a and the cavity block 14b to the mold 14 of one, or to halve and decompose.

[0041]It is because thermal conductivity of copper is good and it is suitable for taking and quenching heat quickly from the hardener 11 of a melting state to make into copper here the cavity blocks 14a and 14b which constitute the mold 14. It is because it is important and conditions to be quenched [this] when cooling to urgency more is connected with solidifying an instant, with the atomic arrangement held currently confused irregularly and it produces an amorphous alloy. Although it was omitting and not being illustrated in drawing 1, the waterway which keeps pouring cooling water is also provided in the cavity blocks 14a and 14b as a means for considering it as more rapid cooling.

[0042]The crevice 21 of the shape which halved the appearance shape of the

desired member made from an amorphous alloy to each, and made it reverse unevenness, i.e., a cavity, is established in the cavity block 14a and the cavity block 14b. Drawing 1 shows the example about the case where the outline shape shown in drawing 3 (a) manufactures the member made from an amorphous alloy of a rectangular parallelepiped. Therefore, the cavity 21 in drawing 1 is made into the shape which halved the rectangular parallelepiped which is the appearance shape of the member made from an amorphous alloy shown in drawing 3 (a), and reversed unevenness.

[0043]The Yuguchi slot 22a and the Yuguchi slot 22b are established in the cavity block 14a and the cavity block 14b by the pair at each. In the state where the cavity block 14a and the cavity block 14b were assembled by the mold 14 of one, when the Yuguchi slot 22a and the Yuguchi slot 22b counter, the sprue hole 22 which is open for free passage from the exterior of the mold 14 to the cavity 21 is formed. From this sprue hole 22, the dissolved hardener 11 will be injected and cast into the cavity 21 of the mold 14 with the amorphous alloy manufacturing device shown in drawing 2, and the member made from an amorphous alloy will be manufactured.

[0044]The degassing slot 23a and the degassing slot 23b are established in the cavity block 14a and the cavity block 14b by the pair at each. In the state where the cavity block 14a and the cavity block 14b were assembled by the mold 14 of one, when the degassing slot 23a and the degassing slot 23b counter, the vent hole 23 which is open for free passage from the inside of the cavity 21 to the exterior of the mold 14 is formed. The purpose of establishing the vent hole 23 in the mold 14 is to prevent generating of a casting defect. When the vent hole 23 was established in the mold 14 and the dissolved hardener 11 is cast into the cavity 21, the gas which is stagnating in the cavity 21 can pass through the vent hole 23, and it can slip out smoothly out of the cavity 21. Then, the inflow of the hardener 11 into the cavity 21 also becomes smooth, and the inside of the cavity 21 fully comes to be filled with the hardener 11. As a result, generating of a casting defect is prevented.

[0045]With the amorphous alloy manufacturing device of composition of having been shown in the mold 14 which has the above-mentioned composition explained so far above at drawing 2. If the dissolved hardener 11 is injected and cast, the member made from an amorphous alloy of a rectangular parallelepiped will be cast for the appearance shape which reversed and

transferred the uneven shape of the cavity 21.

[0046]However, since this first example is an example in the case of manufacturing the member made from an amorphous alloy which has the through hole 18a shown in drawing 3 (a), The composition of the mold 14 did not stop at above-mentioned composition, but has taught the hollow pipe material 19a which has an inside diameter still more nearly equal to the hole of the request to the hole position in the mold 14 to it.

[0047]The hollow pipe material 19a is taught to the hole position in the mold 14 as follows.

[0048]The hollow pipe material 19a which, first of all, has an inside diameter equal to the through hole 18a is prepared, and length is cut equally to the length of the through hole 18a. The round bar 24 which has a centrum of the hollow pipe material 19a and an outer diameter which fits in is prepared. Let the length of the round bar 24 be a long thing more moderately than the length of the hollow pipe material 19a made equal to the length of the through hole 18a.

[0049]Then, the round bar 24 is inserted in the centrum of the hollow pipe material 19a prepared above. Equivalent length changes the ends 24a and 24b of the round bar 24 into the state where it projected from the both ends of the hollow pipe material 19a, at this time.

[0050]the ends 24a and 24b of the round bar 24 which attached the hollow pipe material 19a outside if it continued -- each is inserted in the semicircular grooves 25a and 25b provided in the cavity block 14a. That is, on the cavity 21, as the round bar 24 which attached the hollow pipe material 19a outside will be in the state of a both-ends supporting beam, it sets. At this time, the half of an outside diameter direction is changed into the state where it was made to insert into the cavity 21, and the hollow pipe material 19a currently attached outside the round bar 24 sets it.

[0051]Here, the semicircular grooves 25a and 25b provided in the cavity block 14a are slots where sectional shape is carrying out semicircular shapes. And the radius of the semicircular grooves 25a and 25b is slightly enlarged rather than the radius of the round bar 24 so that an insert lump of the round bar 24 may be possible. As the semicircular grooves 25a and 25b become the semicircular grooves 25a and 25b by the side of the cavity block 14a, and a pair, they are provided also in another cavity block 14b side.

[0052]Therefore, if the cavity blocks 14a and 14b are assembled to the mold 14 of one where the round bar 24 outside which the hollow pipe material 19a was made to attach as mentioned above is set, The ends 24a and 24b of the round bar 24 will be put and held by the semicircular grooves 25a and 25b provided in the cavity blocks 14a and 14b by the pair.

[0053]In the state where the mold 14 was assembled as mentioned above, the hollow pipe material 19a is in the state attached outside the round bar 24, and is interpolated in the cavity 21 of the mold 14. That is, the hollow pipe material 19a is taught into the mold 14.

[0054]In the manufacturing method of the member made from an amorphous alloy of this invention, the hole which consists of a centrum of the hollow pipe material 19a is formed into the member made from an amorphous alloy. That is, the hole using the centrum of the hollow pipe material 19a is formed into the member made from an amorphous alloy. Therefore, in teaching the hollow pipe material 19a into the mold 14, the hollow pipe material 19a must be taught to the appropriate position in the cavity 21 of the mold 14. An appropriate position is a hole position in the cavity 21 equivalent to the hole position of the member made from an amorphous alloy which manufactures.

[0055]Therefore, about the semicircular grooves 25a and 25b which determine the position of the hollow pipe material 19a within the cavity 21, it is suitably decided on the cavity block 14a and 14b that it will be a position which can teach the hollow pipe material 19a to an above appropriate position.

[0056]With the amorphous alloy manufacturing device of composition of having been shown in drawing 2 to the mold 14 which taught and assembled the hollow pipe material 19a which has an inside diameter equal to a desired hole in the position which carries out like the above explanation and is equivalent to the hole position in the cavity 21. If the dissolved hardener 11 is injected and cast, as the hollow pipe material 19a taught in the cavity 21 is wrapped in, the hardener 11 will flow into the circumference of the hollow pipe material 19a, and the member made from an amorphous alloy will be cast.

[0057]Incidentally the hardener 11 used for this example is a zirconium system crystalline alloy which consists of copper 30at% of presentation nickel 5at% aluminum 10at% zirconium 55at%, and the amorphous alloy

obtained after casting is a zirconium system amorphous alloy of the presentation. However, as long as it is an alloy of the presentation which can grow into an amorphous alloy not only the zirconium system crystalline alloy of a presentation used for this example about the hardener 11 but after casting, you may be an alloy of other presentations.

[0058]The hollow pipe material 19a in this example is hollow pipe material made from commercial stainless steel.

[0059]The peripheral side face of the hollow pipe material 19a in this example is made into the mere smooth cylinder side. however, the periphery side ** of the hollow pipe material 19a -- it is not necessarily limited to a mere smooth cylinder side. For example, a slot may be established in the cylinder side of the hollow pipe material 19a, or surface roughness may be damaged, and uneven shape may be given to the surface. In this case, when the amorphous alloy formed in the crevice of the uneven shape given to the cylindrical surface of the hollow pipe material 19a by casting of the hardener 11 enters, An anchor effect is demonstrated and the bonding strength of the joined part of the hollow pipe material 19a and amorphous alloy parts can be raised.

[0060]In this example, the amorphous alloy manufacturing device used in order to cast the hardener 11 to the mold 14 is an amorphous metal manufacturing device by Nissin Research Institute, Inc. (form: NEV-A1 type), and the devices are the amorphous alloy manufacturing device shown in drawing 2, and a device which has the same composition.

[0061]Foundry practice by the device is performed according to the following procedures. First of all, evacuation of the inside of the chamber 15 is carried out with the vacuum pump (not shown in drawing 2) connected to the vacuum suction port 16. Next, few quantity of argon gas is introduced in the chamber 15 from the inactive gas introduction port 17, and the inside of the chamber 15 is adjusted to the inert gas atmosphere of negative pressure to such an extent that the inside of the chamber 15 maintains at negative pressure. Next, current is sent through the high-frequency-induction coil 13, and it heats and dissolves by 1000 ** more than the melting point, the hardener 11, i.e., the zirconium system crystalline alloy of the above-mentioned presentation, which have been paid into the syringe 12. If the hardener 11 dissolves uniformly on the whole, the current supply source to the high-frequency-induction coil 13 will be

suspended, and heating of the hardener 11 will be suspended. Then, it waits for several seconds until the temperature of the dissolved hardener 11 falls at 900 ** in the state as it is. And at the moment of becoming 900 **, the temperature of the hardener 11 of a melting state introduces argon gas by a 0.6 Kgf(s)/square centimeter pressure from the inactive gas introduction port 12a, and pressurizes the inside of the syringe 12, The dissolved hardener 11 is made to inject from the nozzle hole 12b, and it casts into the mold 14. Here, a noncontact radiation thermometer is used over the inspection hole (not shown in drawing 2) provided in the chamber 15 so that the heating melting state of the hardener 11 can check the temperature of the hardener 11 visually as a detecting method, and the temperature survey of the hardener 11 is carried out.

[0062]After casting the hardener 11, the casting, i.e., the cast member made from an amorphous alloy, can be taken out from the mold 14 by removing the bolt 20 and disassembling the mold 14. Here, the member made from an amorphous alloy just taken out from the mold 14 is shown in drawing 4. As shown in drawing 4, the member 18 made from an amorphous alloy just taken out from the mold 14 is in the state where the hollow pipe material 19a which has an inside diameter equal to a desired hole in a desired hole position, and the round bar 24 in the state where it was inserted in the centrum of the hollow pipe material 19a are included.

[0063]Then, about the round bar 24 inserted in the hollow pipe material 19a, it samples and removes from the hollow pipe material 19a. Then, the member only made from an amorphous alloy which included the hollow pipe material 19a which has an inside diameter equal to a desired hole in a desired position is obtained. That is, the member 18 made from an amorphous alloy in which the through hole 18a of the desired inner diameter which becomes a desired position from the centrum of the hollow pipe material 19a was formed is obtained.

[0064]The shape of the result which the appearance shape of the member 18 made from an amorphous alloy reversed the uneven shape of the cavity 21, and was transferred is obtained. However, as shown also in drawing 4, when it takes out from the mold 14, the formed unnecessary part 26 is attached by the portion of the sprue hole 22 of the mold 14, and the portion of the vent hole 23. Therefore, it cannot be overemphasized that it cuts off and removes in a post process about this unnecessary part 26. As mentioned above,

the amorphous alloy has high hardness and is material with difficult cutting. Therefore, as a method of cutting off and removing the unnecessary part 26 in a post process, cutting-down processing by the thin edge emery wheel stone of the diamond abrasive grain which has the high hardness more than an amorphous alloy is effective. In cutting-down processing by this diamond abrasive grain thin edge emery wheel stone, it cannot be overemphasized that the neighborhood of a processing section carries out temperature up by recrystallizing temperature depending on the accumulation of temperature increase by plastic working, and sufficient attention is paid so that an amorphous alloy may not crystallize. Wet cutting-down processing is performed cooling near the processing section fully covering grinding fluid.

[0065]Thus, in this first example, the member 18 made from an amorphous alloy which has the through hole 18a shown in drawing 3 (a) is manufactured.

[0066]In the first example mentioned above, the length of the hollow pipe material 19a may be made longer than the length of the through hole 18a, although it was made beforehand equal to the length of the through hole 18a. In that case, the same with cutting off the unnecessary part 26 by a post process, the hollow pipe material 19a will also be cut off and step can be kept with the desired length.

[0067](The second example) The method of manufacturing the member 18 made from an amorphous alloy which has next the penetration female screw hole 18c shown in drawing 3 (c) with the manufacturing method of the member made from an amorphous alloy of this invention as the second example is explained below. The member 18 made from an amorphous alloy which has the penetration female screw hole 18c shown in drawing 3 (c) can be manufactured by the same method as the first example mentioned above. Since the nut 19c which has a female screw hole equal to the desired penetration female screw hole 18c is taught to the female screw hole position in the mold 14, if a hardener is cast around the nut 19c and the member 18 made from an amorphous alloy is cast, The member 18 made from an amorphous alloy which has the penetration female screw hole 18c shown in drawing 3 (c) can be manufactured. That is, if it transposes to the nut 19c which has a female screw hole equal to the penetration female screw hole 18c of a request of the hollow pipe material 19a in drawing 1, the member 18 made from an amorphous alloy which has the penetration female screw hole 18c shown in drawing 3 (c) can be manufactured.

Incidentally, the nut made from stainless steel is used for the nut 19c in this example.

[0068] (The third example) The method of manufacturing the member 18 made from an amorphous alloy which has next the sac hole 18b shown in drawing 3 (b) with the manufacturing method of the member made from an amorphous alloy of this invention as the third example is explained below. The member 18 made from an amorphous alloy which has the sac hole 18b shown in drawing 3 (b) can also be manufactured by the same method as the first example mentioned above. Since the saccate pipe material 19b which has a hole of an inside diameter equal to the desired sac hole 18b and the depth is taught to the sac hole position in the mold 14, if a hardener is cast around the saccate pipe material 19b and the member 18 made from an amorphous alloy is cast, The member 18 made from an amorphous alloy which has the sac hole 18b shown in drawing 3 (b) can be manufactured. That is, if it transposes to the saccate pipe material 19b which has a hole of an inside diameter equal to the sac hole 18b of a request of the hollow pipe material 19a, and the depth in drawing 1, the member 18 made from an amorphous alloy which has the sac hole 18b shown in drawing 3 (b) can be manufactured.

[0069] In the first example, as shown in drawing 1, the hollow pipe material 19a is set to the state of a both-ends supporting beam on the cavity 21. However, the thing called the saccate pipe material 19b in this third example is the hollow pipe material of the shape which closed one hollow opening part among the hollow opening parts in the both ends of the hollow pipe material 19a in the first example. Therefore, in this third example, when preparing the saccate pipe material 19b into the mold 14, the saccate pipe material 19b will be set to the state of a cantilever on the cavity 21. Incidentally, the saccate pipe material made from stainless steel is used for the saccate pipe material 19b in this example.

[0070] (The fourth example) The method of manufacturing the member 18 made from an amorphous alloy which has next 18 d of bag female screw holes shown in drawing 3 (d) with the manufacturing method of the member made from an amorphous alloy of this invention as the fourth example is explained below. The member 18 made from an amorphous alloy which has 18 d of bag female screw holes shown in drawing 3 (d) can also be manufactured by the same method as the first example mentioned above. Since the saccate nut 19d which has a female screw mountain equal to 18 d of desired bag female screw holes

and a female screw hole of the depth is taught to the sac hole position in the mold 14, If a hardener is cast to the saccate nut [19d] circumference and the member 18 made from an amorphous alloy is cast, the member 18 made from an amorphous alloy which has 18 d of bag female screw holes shown in drawing 3 (d) can be manufactured. That is, if it transposes to the saccate nut 19d which has the female screw mountain equal to 18 d of bag female screw holes of a request of the hollow pipe material 19a and the female screw hole of the depth in drawing 1, the member 18 made from an amorphous alloy which has 18 d of bag female screw holes shown in drawing 3 (d) can be manufactured.

[0071]In this fourth example, when teaching the saccate nut 19d into the mold 14, the saccate nut 19d will be set to the state of a cantilever on the cavity 21 like the third example.

[0072]Incidentally, the saccate nut made from stainless steel is used for the saccate nut 19d in this example.

[0073]In the above, the member made from an amorphous alloy which has even here the hole shown in drawing 3 or a female screw hole has explained that it can manufacture with the manufacturing method of the member made from an amorphous alloy by this invention.

[0074]What can be manufactured is not necessarily limited to the member made from an amorphous alloy of a rectangular parallelepiped with simple appearance shape shown in drawing 3 by the manufacturing method of the (fifth example), however the member made from an amorphous alloy by this invention. Manufacture of the member made from an amorphous alloy which carried out all complicated appearance shape is also possible.

[0075]So, below, it is a member made from an amorphous alloy which can be manufactured with the manufacturing method of the member made from an amorphous alloy by this invention, and two examples with appearance shape more complicated than the example moreover shown in drawing 3 are shown as the fifth example.

[0076]Drawing 5 is an explanatory view showing the exterior member for wrist watches manufactured with the manufacturing method of the member made from an amorphous alloy by this invention. Drawing 5 (a) is the wristwatch case 27 made from an amorphous alloy which comprises an amorphous alloy, and drawing 5 (b) is the wristwatch bracelet piece 28 made from an amorphous alloy which comprises an amorphous alloy.

[0077]In the wristwatch case 27 made from an amorphous alloy shown in drawing 5 (a), the crown hole 29 for letting a crown axis (not shown) pass and the band mounting hole 30 for attaching a band (not shown) are formed by the hollow pipe material 19a made from stainless steel. The female screw hole 31 for rear lids for attaching a rear lid (not shown) is formed with the nut 19c made from stainless steel.

[0078]In the wristwatch bracelet piece 28 made from an amorphous alloy shown in drawing 5 (b), When connecting two or more wristwatch bracelet pieces 28 made from an amorphous alloy and assembling as a wristwatch bracelet, the pin hole 32 for letting a pin (not shown) pass is formed by the hollow pipe material 19a made from stainless steel.

[0079](The sixth example) In the second, third, fourth, and fifth example, for a start which was explained so far above. Since the member made from stainless steel manufactured by other processes is taught into the mold, the example which forms in the member of one the amorphous alloy parts obtained by casting said member and said hardener depending on casting a hardener to the circumference of said member has been described. However, the member manufactured by other processes taught into the mold with the manufacturing method of the member made from an amorphous alloy by this invention is not necessarily limited only to the product made from stainless steel. As long as it is the construction material which can bear the casting temperature of a hardener as construction material of the member manufactured by other processes taught into the mold, metal other than stainless steel may be sufficient, and ceramics etc. may be used. If the member eventually manufactured depending on the case is expected uniform composition, it will not matter at all even if it is an amorphous alloy obtained by casting the crystalline alloy of the same presentation as the hardener to cast, or a hardener.

[0080]Then, the case where the members manufactured next by other processes taught into the mold are other construction material other than stainless steel is shown as the sixth example.

[0081]In the manufacturing method of the member made from an amorphous alloy by this invention, drawing 6 is an explanatory view showing the sixth example in case the members manufactured by other processes taught into the mold are other construction material other than stainless steel.

[0082]In the manufacturing method of the member made from an amorphous alloy

specifically according [drawing 6 (a)] to this invention, Since the hollow pipe material 19a made from the alloy for bearings manufactured by other processes is taught into the mold, it is the product axis-of-rotation receptacle member 33 made from an amorphous alloy manufactured by casting a hardener around the hollow pipe material 19a made from the alloy for bearings. Although the product axis-of-rotation receptacle member 33 made from an amorphous alloy shown in drawing 6 (a) is a member holding the axis of rotation 34 which rotates in the direction of arrow A, it forms the fitting hole 35 with the axis of rotation 34 by the hollow pipe material 19a made from the alloy for bearings.

[0083]In the manufacturing method of the member made from an amorphous alloy according [drawing 6 (b)] to this invention, Since the block 36 with a slot made from the alloy for bearings manufactured by other processes is taught into the mold, it is the slide member 38 made from an amorphous alloy manufactured by casting a hardener to the circumference except the slot 37 of the block 36 with a slot. Although the slide member 38 made from an amorphous alloy shown in drawing 6 (b) is a member which slides on the track rail 39 top in the direction of arrow B, it forms the contact surface 40 with the track rail 39 with the block 36 with a slot made from the alloy for bearings.

[0084]

[Effect of the Invention]The manufacturing method of the member made from an amorphous alloy in this invention like [it is ****** and] by the above explanation, Depending on casting a hardener to a part of circumferences of said member which inserted into the mold at least a part of member manufactured by other processes, and was inserted into said mold. The amorphous alloy parts obtained by casting the member manufactured by the process besides the above and said hardener are formed in the member of one.

[0085]The manufacturing method of the member made from an amorphous alloy in this invention, Since the hollow pipe material which has an inside diameter equal to a desired hole is taught to the hole position in a mold in the method of manufacturing the member made from an amorphous alloy which has a hole, A hardener is cast around said hollow pipe material, the member made from an amorphous alloy is cast, and the hole which consists of a centrum of said hollow pipe material is formed into the member made from

an amorphous alloy.

[0086]Or the manufacturing method of the member made from an amorphous alloy in this invention, In the method of manufacturing the member made from an amorphous alloy which has a female screw hole, Since the nut which has a desired female screw hole and an equal female screw hole is taught to the female screw hole position in a mold, a hardener is cast around said nut, the member made from an amorphous alloy is cast, and the female screw hole which consists of a female screw hole of said nut is formed into the member made from an amorphous alloy.

[0087]Therefore, according to the manufacturing method of the member made from an amorphous alloy in this invention. In the manufacturing method of the member made from an amorphous alloy which has a hole or a female screw hole, even if it forms neither a hole nor a female screw hole by cutting, the manufacturing method of the member made from an amorphous alloy which can form a hole or a female screw hole can be provided.

[0088]As a result, although it is amorphous therefore, it excels in corrosion resistance, and in the member made from an amorphous alloy which has hardness high moreover and high intensity, the member which has a hole or a female screw hole can be provided. It excels in corrosion resistance, it is hard to get damaged as an example, and the wristwatch case made from an amorphous alloy shown in the fifth strong example, the wristwatch bracelet made from an amorphous alloy, etc. can be provided.

[0089]The manufacturing method of the member having the outstanding characteristic which the member manufactured by other processes has, and the outstanding characteristic which an amorphous alloy has can be provided.

[0090]As a result, the new member having the outstanding characteristic which the member manufactured by other processes has, and the outstanding characteristic which an amorphous alloy has can be provided. It excels in corrosion resistance, it is hard to get damaged as an example, and the product axis-of-rotation receptacle member made from an amorphous alloy shown in the sixth strong example, the slide member made from an amorphous alloy, etc. can be provided.

[Brief Description of the Drawings]

[Drawing 1]In the manufacturing method of the member made from an amorphous alloy by this invention, it is a decomposition explanatory view of the mold

in which the state where the hollow pipe material which has an inside diameter equal to a desired hole was taught to the hole position in a mold is shown.

[Drawing 2]It is an approximate account figure of the amorphous alloy manufacturing device used in order to make the hardener of a crystalline substance amorphous and to produce an amorphous alloy.

[Drawing 3]It is an explanatory view including the important section sectional view showing the example of the member made from an amorphous alloy which has a hole manufactured or a female screw hole with the manufacturing method of the member made from an amorphous alloy by this invention.

[Drawing 4]In the example of the manufacturing method of the member made from an amorphous alloy by this invention, it is an explanatory view showing the member made from an amorphous alloy just taken out from the mold.

[Drawing 5]It is an explanatory view showing the exterior member for the product wrist watches made from an amorphous alloy manufactured with the manufacturing method of the member made from an amorphous alloy by this invention.

[Drawing 6]It is an explanatory view showing the product axis-of-rotation receptacle member made from an amorphous alloy and the slide member made from an amorphous alloy which were manufactured with the manufacturing method of the member made from an amorphous alloy by this invention.

[Description of Notations]

11 Hardener gold

14 Mold

18 The member made from an amorphous alloy

18a Through hole

18b Sac hole

18c Penetration female screw hole

18 d Bag female screw hole

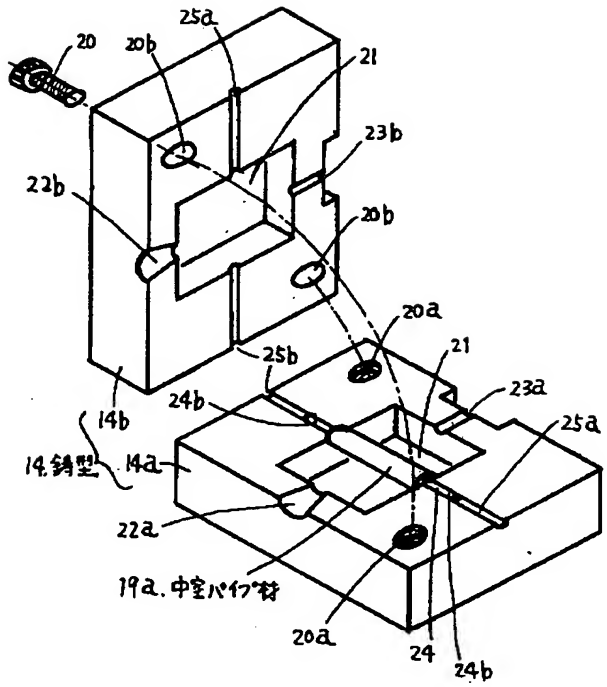
19a Hollow pipe material

19b Saccate pipe material

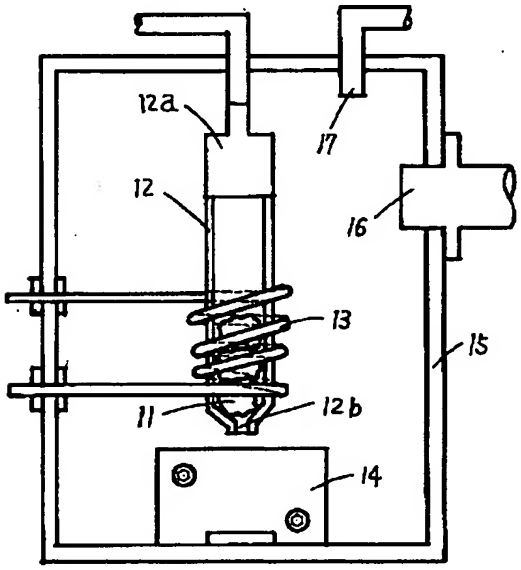
19c Nut

19 d Saccate nut

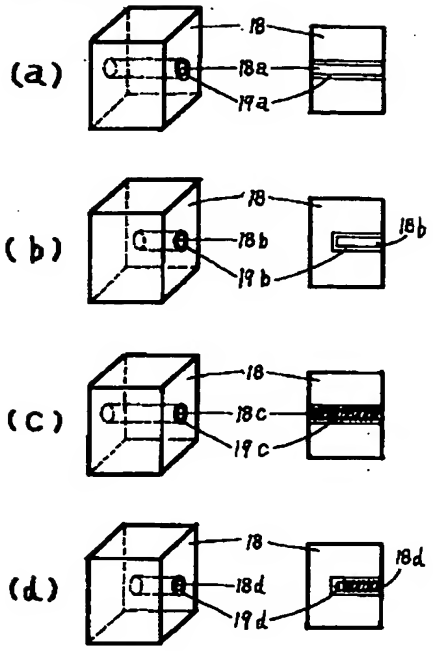
[Drawing 1]



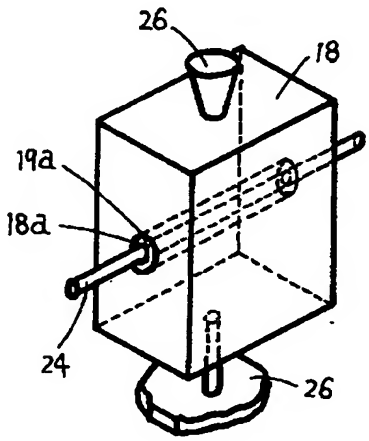
[Drawing 2]



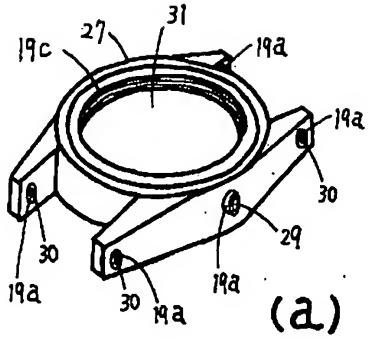
[Drawing 3]

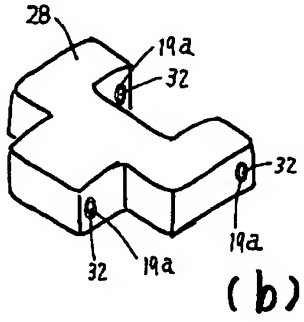


[Drawing 4]



[Drawing 5]





[Drawing 6]